13-P: Real-Time Instrumentation for Monitoring Radiation-Induced DNA Degradation (RTDNA)

Problem Statement

- There is currently no flight-ready DNA melting analysis hardware available in a low-G environment. Hardware will be used to determine, in real time, the level of DNA damage caused by radiation in the spaceflight environment.
- This flight opportunity will demonstrate hardware functionality in low and high gravity environments.
- Potential users of the matured technology include ISS space biology researchers and medical professionals on Earth.

Technology Development Team

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Proposed Flight Experiment

Experiment Readiness:

- September 2012

Test Vehicles:

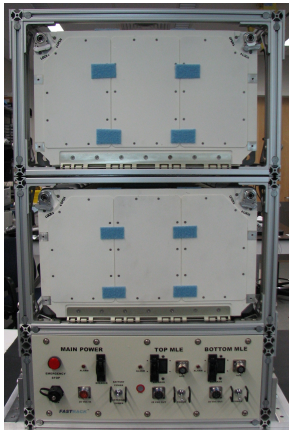
- Parabolic aircraft

Test Environment:

- Previously flew on Flight Opportunities Program parabolic flights in September 2011

Test Apparatus Description:

- Test apparatus and operator interfaces are FASTRACK™ plus a free-float apparatus containing the RTDNA hardware. FASTRACK™ will supply power to the free-float apparatus. The free-float apparatus will melt DNA solution in an enclosed microfluidic channel device. Fluorescent images will be taken as the DNA melts. Data will consist of the fluorescent images and accelerometer values, correlated to real-time flight progression and any start/stop changes in DNA fluid pumping. The RTDNA hardware will be unpowered during takeoff and landing.



Technology Maturation

- Technology currently TRL4
- TRL5 reached following parabolic flights by proving the following technologies:
  - DNA solution pumping
  - Produce thermal gradient
  - DNA imaging
- TRL6 achieved by future Nanosatellite or NanoRacks flight

Objective of Proposed Experiment

- DNA will be melted to physically separate the two strands of DNA in the double helix.
- Fluorescent images of the melted DNA will be acquired to monitor the DNA's transition from double-stranded to single-stranded.
- Expected flight data will evaluate the effects of the reduced gravity environment on fluid function and thermal gradients within the RTDNA hardware.

List the applicable Technology Areas addressed by your technology: www.nasa.gov/offices/oct/home/roadmaps